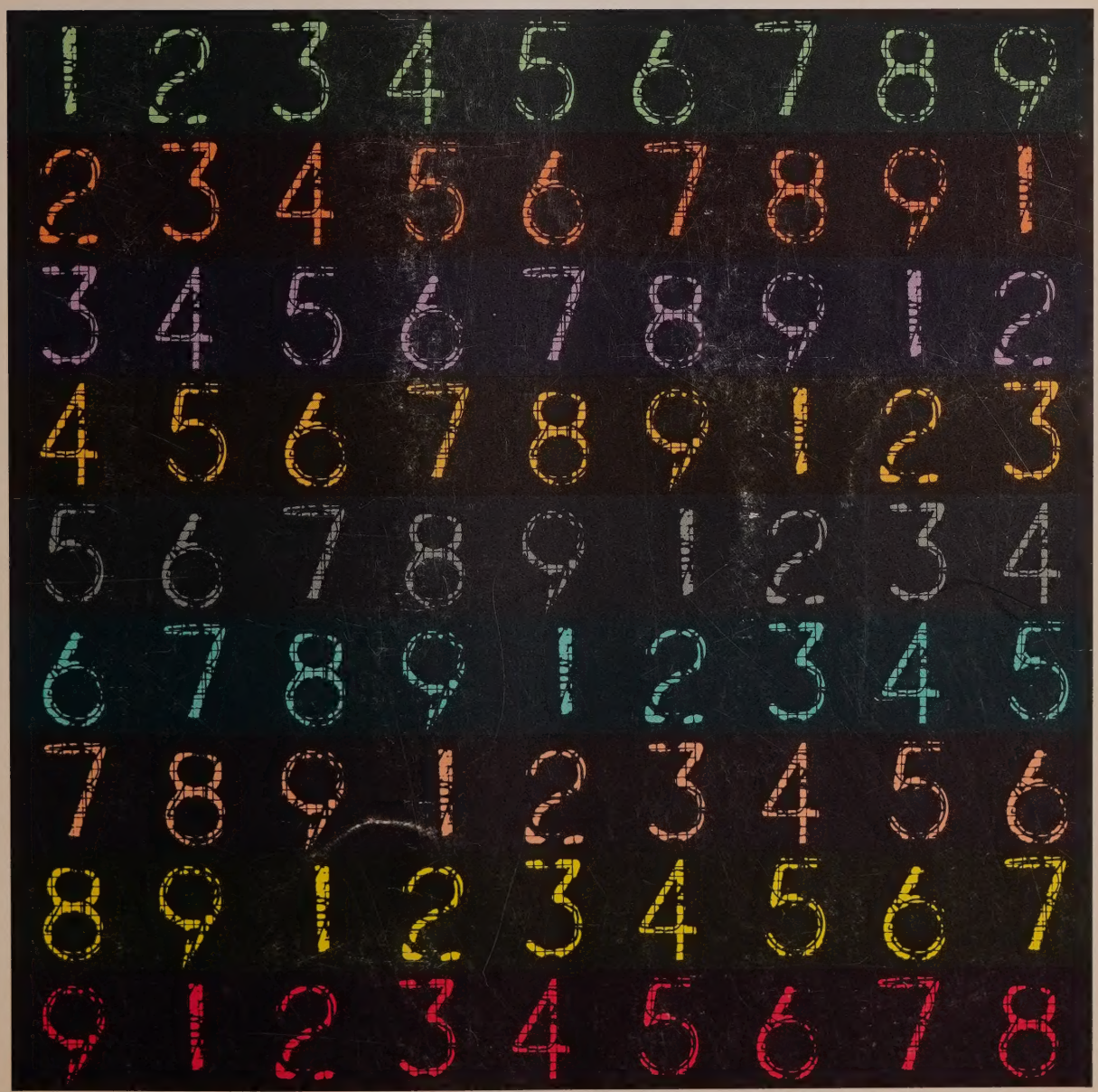
COUNTER / TIMER

INSTRUCTION MANUAL

SD 1944A



SYSTRON-DONNER CORPORATION • 888 GALINDO STREET • CONCORD, CALIFORNIA 94520 • PHONE: (415) 682-6161 • TWX: 910-481-9478
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1 manual TO Cal. Lab

MODEL 1944A

PRESET PLUG-IN

PRELIMINARY MANUAL

OFFICIAL RECORDS STATION
FILE COPY
FACILITIES NOV 7 - 1969

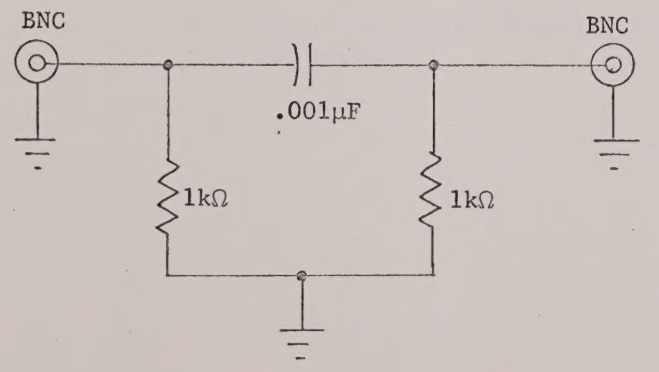
Systron-Donner Corporation
888 Galindo Street
Concord, California 94520

IMPORTANT NOTICE

The Model 1944A can be used with a Model 1013 Counter if the following procedure is followed:

FUNCTION		OPERATION
F/N	RATE:	Connect the adaptor box shown below between the 1944A output and 1013 input. Connect the input signal to the 1944A input.
NXF	RATE:	Connect the input signal to the 1013 input; select the N number on the 1944A.
Normal		Connect the input signal to the 1013 input.
NXP or P/N	PERIOD:	Connect the input signal to the 1944A input jack.

AND refer to Drawing S23494: C12 must be installed for operation with a Model 1013. It must be removed for operation with any other counter.



ADAPTOR BOX
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SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

1.2 The Model 1944A Preset Plug-In is designed for use with any of Systron-Donner's digital measuring instruments with the versatile front plug-in design. The plug-in is provided with six distinct operating functions and can be used as a frequency meter, straight high speed counter, preset counter, period or pulse-width timer, flowmeter calibrator, or ratio measuring instrument. When installed, the preset plug-in enables the counter to readout measurements directly in engineering units. By proper adjustment of the front panel counter controls, the input signal can be read out directly in GPM, lb/sec, yards, or any other convenient engineering unit.

1.3 Each plug-in unit contains one input channel which features AC or DC coupling, a five step 1:100 attenuator, variable trigger level control for precise selection of timing intervals and optimum count reliability and slope for selection for triggering with either positive or negative going wave forms.

TABLE 1-1

MODEL 1944 PRESET PLUG-IN SPECIFICATIONS

PRESET FUNCTIONS	N = 1 to 99,999	
NXF	Measures frequency during N Time Base Period	DC to 10 Mc
P/N	Measures period in N X 10 μsec Timing Unit	DC to 10 Mc

TABLE 1.1
(Cont.)

PRESET FUNCTIONS	N = 1 to 99,999	
NXP	Times Period of N input cycles	DC to 1MHz
F/N	Divides input frequency by N	DC to 1MHz
Normal	Counts input cycles	DC to 10MHz

NORMAL FUNCTIONS DC to 10Mc

NXF, P/N and Normal

INPUT

Sensitivity	0.1v rms
Impedance	1MΩ, 40 pf on 1, 3 attenuator positions 10MΩ, 40 pf on 10, 30, 100 attenuator positions
Coupling:	AC or DC, switch selectable
Slope Selection:	+ and -

TIME BASE SELECTION

Normal

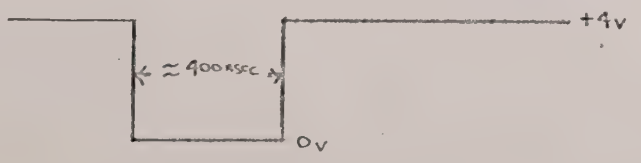
F/N 10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}, 10^{-2}, 10^{-1}, 1, 10

NXP

P/N	10 μs to	.99999	secs in 10 μs steps
	100 μs to	9.9999	secs in 100 μs steps
NXF	1 ms to	99.999	secs in 1 ms steps
	10 ms to	999.99	secs in 10 ms steps
	100 μs to	9999.9	secs in 100 ms steps
	1 sec to	99999.	secs in 1 sec steps

OUTPUT

Negative 4 volt pulse, period equals N x Time Base setting, or N x Frequency.



SECTION II

INSTALLATION

2.1 INITIAL INSPECTION

2.2 As soon as the Model 1944A is received, verify that the instrument is intact and as ordered. Inspect the plug-in for any physical damage such as scratched panel, broken knob, or bent connectors. If damage is found, refer to the warranty page at the front of this manual and Para. 2.5 for shipping and re-packaging instructions.

2.3 STORAGE AND RESHIPMENT

2.4 ENVIRONMENT

Conditions during storage and shipment should be limited as follows:

a. Maximum temperature +85°C

b. Minimum temperature -55°C

2.5 PACKAGING

To protect your instrument during shipment or storage, use the best packaging methods available. Your Systron-Donner field office can provide materials similar to those used for original factory packaging. Contract packaging companies can provide dependable custom packaging on short notice.

a. If possible, use the original container designed for the instrument. Otherwise, use a strong carton (350 lb/sq inch bursting strength) or wooden box to house the instrument.

b. Wrap the instrument in heavy paper or plastic before placing it in the shipping container.

c. Use plenty of packing material around all sides of the instrument and protect the front panel with cardboard strips.

d. Seal the package with strong tape or metal bands. Mark with "Delicate Instrument".

e. Refer to the warranty page at the rear of this manual and check with your Systron-Donner field office for shipping instructions. All correspondence should refer to an instrument by model number and serial number.

2.6 INSTALLATION

2.7 To install the preset plug-in in the compartment provided at the right side of the counter front panel, proceed as follows:

a. Remove AC power from the counter.

b. Loosen locking screw on side of the plug-in compartment by turning fully counter clockwise.

c. Remove blank filler panel or plug-in unit installed.

d. Made certain the 50 pin jack at the rear of the plug-in is properly aligned with the mating connector in the counter and slide the plug-in into the counter.

e. Tighten locking screw by turning fully clockwise.

2.8 COOLING

2.9 The plug-in unit is cooled by the ventilation of the counter in which it is installed.

2.10 POWER REQUIREMENTS

2.11 All voltages required to operate the Model 1944A are supplied by the circuits of the counter in which the plug-in is installed.

2.12 ELECTRICAL CONNECTIONS

2.13 The INPUT terminal on the front panel of the plug-in provides the only connection for the input signal.* The front panel

---

*The output connector must be used with the 1013 Counter in order to perform one of the functions to be described in this text.

OUTPUT connector supplies the output for monitoring or external equipment. All connections to the counter are completed through the 50-pin jack at the rear of the plug-in unit.

SECTION III

OPERATION

3.1 TRIGGER LEVEL CONTROL

3.2 The "Level" control on the plug-in enables one to select the DC voltage level which will produce consistent trigerring of the counting circuitry. The trigger voltage level is adjustable between approximately +5 volts and -5 volts with reference to the attenuated input signal. In terms of the unattenuated signal applied to the input jack, the trigger level is equal to the product of the selected attenuation factor and the trigger level voltage of the attenuated signal.

3.3 Adjust counter trigger level as follows:

(1) Set function switch to COUNT

(2) Turn LEVEL control until counter starts to count.

(3) Continue turning LEVEL control until counter ceases to count.

(4) "Back-off" LEVEL control to mid-point between the "start count" and "stop count" limits.

3.4 This is a convenient way to select a trigger voltage level at approximately the center of the steepest slope of the input waveform and will reduce the possibility of spurious pulses from noise causing false count. The relationship between triggering level and attenuation is illustrated in Figure 3.3

3.5 SLOPE CONTROLS

3.6 The Model 1944A Plug-In is provided with slope switches which are used in conjunction with the Trigger voltage controls. In

3.6 Cont. the + position, the channel will produce a triggering pulse when the input signal rises to the selected trigger voltage level, and in the "-" position when the signal falls to the selected trigger voltage level.

TABLE 3.1

FUNCTION vs CONTROL SETTING

FUNCTION SELECTED/READOUT	CONTROL SETTINGS
1. P/N Readout will be period of input signal divided by thumbwheel switch setting.	(a) Set counter function switch to PER or PER x10 or PER x100 (b) Set in desired number (N) with plug-in thumbwheel switches.
2. F/N Readout will be input rate divided by thumbwheel switch setting.	(a) Set counter function switch to RATE. (b) Set in desired number (N) with plug-in thumbwheel switches.
3. P X N Counter readout will be the period in μs, ms, or sec times thumbwheel setting.	(a) Set counter function switch to PER or PER x10 or PER x100 (b) Set desired number (N) with thumbwheel switches.
4. F X N Readout will be input rate times thumbwheel switch setting.	(a) Set counter function switch to RATE (b) Set in desired number (N) with plug-in thumbwheel switches.
5. NORMAL	(a) Set function switch to RATE.

3.7 RANGE SELECTOR

3.8 This control on the Rate (c) channel selects an attenuation factor of X1, 3, 10, 30, or 100. Both the AC and DC components of the input signal are divided by the selected attenuation factor. The input amplitude should be

3.8 Cont. attenuated to within +150 volts peak-to-peak to protect the attenuator from overload. If the signal is attenuated to approximately 0.25V peak-to-peak, the instrument will not count. To minimize the effects of noise, it is desirable to select an attenuation factor that will reduce the noise component of input signal to less than 0.025 volts peak-to-peak. Even when properly attenuated, the maximum signal which should be applied to the input connector is 500 volts peak-to-peak. Larger signals must be attenuated externally.

3.9 PRESET THUMBWHEEL SWITCHES

3.10 The digital thumb switches on the Preset Plug-In can be set to any number from 1 to 99,999. They can be used to select a precise time base for frequency measurements or a special clock frequency for timing functions.

3.11 PLUG-IN FUNCTION SELECTOR

3.12 Three positions select NORMAL; N X P, F/N and P/N, F X N.

3.13 F X N (Counting Frequency)

With the plug-in function switch at "Rate x N" the instrument will measure frequency by counting the number of cycles which occur during a precise, variable time interval. When the frequency to be measured is the output signal of a tachometer, flowmeter or other transducer, the counting interval may be selected to produce indications in meaningful units such as gals/min, lbs/hour or rpm. For example, if a flowmeter generates 1762 cps at a flow rate of 10,000 lbs/hour, we would select a counting interval of 1.000 divided by 1.762 or 0.5675 seconds. This would cause the counter to indicate "1000" at 10,000 lbs/hour. With this counting

3.13 Cont. interval any rate over the full range will be indicated in tens of pounds per hour. When used with other transducers a similar adjustment of the counting interval will produce readings in rpm, psi, or any other desired units. Once set up, the instrument makes repeated measurements automatically.

3.14 P X N (Measuring Period)

Switched to "Period X N" the instrument will time any number of input cycles from one to 99,999. Extremely accurate period measurements can be made by measuring the duration of a large number of cycles.

Periods of input signals are timed simply by positioning the digital switches to the selected number of cycles to be measured and rotating the "TIME BASE" switch to the desired timing units. By timing the duration of a large number of cycles, the instrument will yield measurements with an extremely high average accuracy.

3.15 F/N

In the RATE/N position, the 1944A divides the input rate by the preset number. The counter accumulates the pre-scaled input for a period of time determined by the Time Base setting.

3.16 P/N

The counter is started and stopped by the input signal. The Time Base signal is divided by N and accumulated in the counter.

3.17 NORMAL

The Plug-In provides only input amplification, attenuation, slope control and trigger level control. All other functions are set with the counter controls.

SECTION IV

CIRCUIT DESCRIPTION

4.1 INPUT ATTENUATOR

The input attenuator includes five divider networks of either 10 megohms, or 1 megohm impedance, by-passed by 40 pf. Adjustable trimmer capacitors are provided for frequency compensation. These are factory-adjusted to obtain proper compensation with a squarewave input. The input circuit of the amplifier has limiters which permit signals up to 500 volts peak-to-peak to be applied to the input terminals. The Trigger Level potentiometer adds a DC bias opposite in polarity to the sign indicated on the panel, to the amplifier input. When the DC level of the input signal is equal to the indicated trigger voltage, a triggering pulse is produced at the amplifier output.

4.2 DC AMPLIFIER SECTION (Refer to Dwg. S23574)

A "FET" is used in the input stage because of its high frequency response and input impedance characteristics. Limiting diodes CR101 and CR102 protect the tube from overload by limiting the grid to ±6 volts. The input stage, V101, function as a cathode follower having very high input impedance and low output impedance for operation into the following transistor circuits. Q101 is an emitter-follower driving the amplifier stage Q102. Potentiometer R108 is the trigger zero adjust potentiometer. It is adjusted so that an output trigger pulse is produced when the input signal passes through zero volts and the TRIGGER LEVEL control is set at "0".

4.3 The amplified output of Q102 which may be a clipped waveform when a sinewave input is applied, drives the following Schmitt Trigger circuit, Q106 and Q107 through emitter followers Q103 and Q104 and the limiting network between them. This circuit has two stable conditions and is triggered from one state to the other when the signal voltage applied to it passes through a threshold level of approximately 0.65 volts in the positive direction or 0.25 volts in the negative direction as measured at the collector of Q102.

4.4 The 0.40 volt difference between the positive and negative threshold levels, referred to as the hysteresis of the Schmitt trigger, is the minimum signal amplitude required to operate the trigger and is equivalent to much less than the rated input sensitivity for channels A.(0.1 volt rms at the input terminals.) The output of the Schmitt Trigger is a squarewave, regardless of the input waveform applied.

4.5 The Schmitt Trigger drives two pulse transformers, T101 and T102. Q105 in the emitter circuit of the Schmitt Trigger provides a constant current source which compensates for the loading effect of the output transformers to help preserve the output squarewave. Each output pulse transformer produces a negative differential waveform, corresponding to either a positive-slope or a negative-slope on the primary, depending on which side of the center-tapped secondary winding is grounded by the SLOPE switch. These negative pulses are fed to the bases of Q108 (A output) and Q109 (A^1 output) which amplify, invert and lengthen them.

SECTION V

MAINTENANCE AND PARTS DATA

5.1 INPUT AMPLIFIER (Sensitivity Adjustment)

a. Attached the scope prove to test point which is located at the top of R103.

b. Set range switch to position 1; AC/DC switch to AC position.

c. Apply a 300 mv, peak-to-peak 1 Mc squarewave from test oscillator to the input.

d. Adjust C7 for a rectangular squarewave.

e. Set range switch to position 3, increse amplitude of test oscillator to 3 volts peak-to-peak. Adjust C9 in a similar way.

E

INPUT (4)

GND (5)

(6)

(7)

GND (8)

C101 .05μf

C102 .05μf

R102

R103 3.2K WW 3W

CR103 IN458

CR104 IN458

CR106 CD6262

R108 WW

R109 1.2K ± 3W, WW

R110 1K ± 10%

C104 100μf

R107 150Ω WW 3W

CR105

Q103 1N4060

Q104 1N4060

REVISIONS					
ISSUE	DESCRIPTION	SER. NO	ECO NO.	DATE	APP. BY:
B	[illegible] Vitreous) R127 R129 WIRE 1K-2W	—	-AM	12-14	
C	CORRECTED PIN DESIGNATIONS	—	-AM	7-15	
D	[illegible] NOTE 2 WAS R 12 [illegible]			10-15	

R 120
1.2K 10%
1W

Q 105
[illegible]

R114
2.7K

R 116
6.2K

R124
160Ω

R 121
300Ω

LR 107

Q 104
14000

Q 106
14000

Q 107
14000

R 122
240Ω

C 109
100 pf

R 113
3.3K

C 110
.05 mf

R 115
3.3K

R 117
220Ω

C 108
.01 mf

R 118
91Ω.

T 101
3:2

Q 105
[illegible]

A

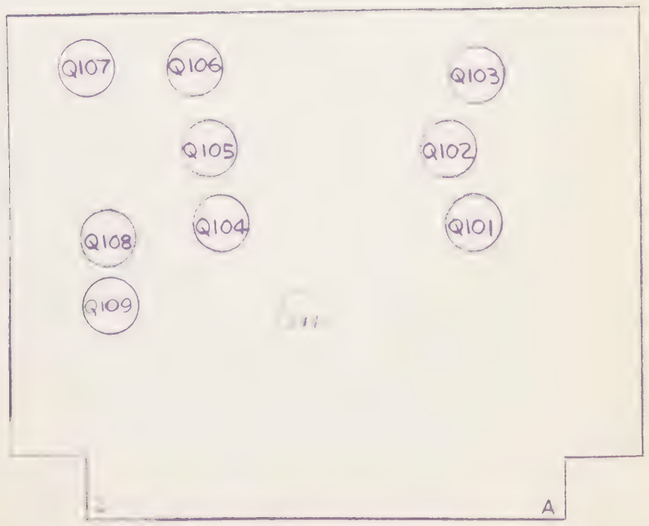
V

A

A'

-30 V. (2)

-30V. (1)



"A" AMPLIFIER

NOTES

UNLESS OTHERWISE S

1. ALL RESISTORS ± 5 %, 0.2

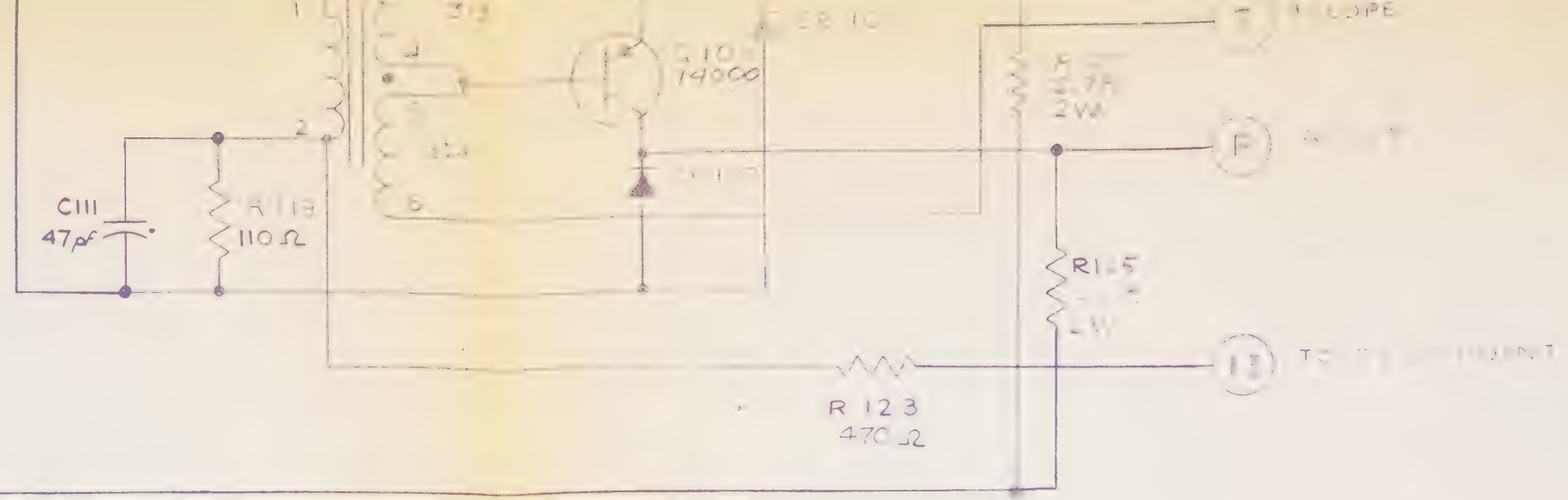
2.

3.

4.

5. ALL DIODES FOR SYSTRE

6. NOMINAL VALUE



FIED ON DRAWINGS

N.

AN 1.0 TYP. IF ptd

MAX. 1.0 TYPE IN ptd

ONNER CORP SPEC. Nº G-6700

DRAWN BY	DATE	UNLESS SPECIFIED, DIMENSIONS: INCHES			
CHECKED BY:	DATE	TOLERANCES:			
PROJ. ENG.	DATE	DECIMAL			
APPROVED BY	DATE	ANGULAR			
		SURFACE FINISH	DET. NO.	ITEM	MATERIAL	QUAN./UNIT
		SCALE	SYSTRON-DONNER CORPORATION		
			CONCORD		CALIFORNIA
			TITLE	DWG. NO.	ISSUE

SCHEM. 525052

INPUT

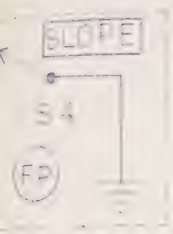
CW

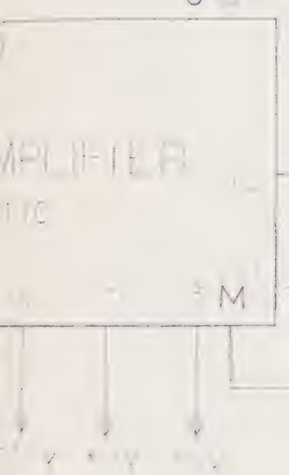
4 | 3 | 2 | 1

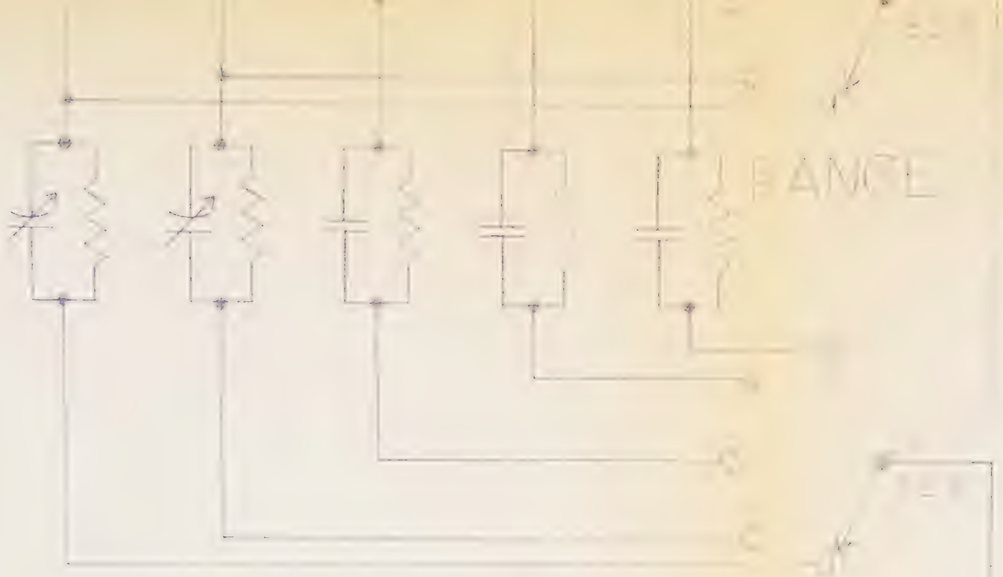
REVISIONS

ISSUE	DESCRIPTION	SER NO.	ECO NO.	DATE	APP BY
C	UPDATED FOR PRODUCTION RELEASE	—	[illegible]	[illegible]	
D	R2 WAS [illegible] CHG TO 470Ω, ADDED R4 [illegible]		[illegible]	[illegible]	
E	CHG R4 FROM N,T&M ON J6		WAC	12/10/68	

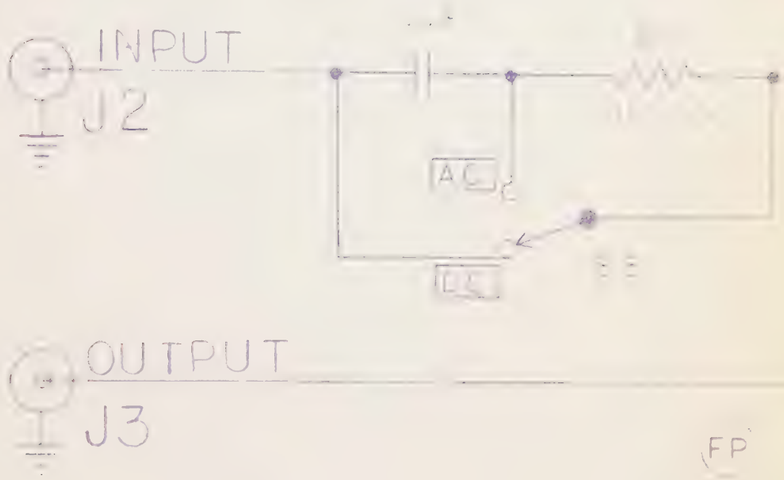
D







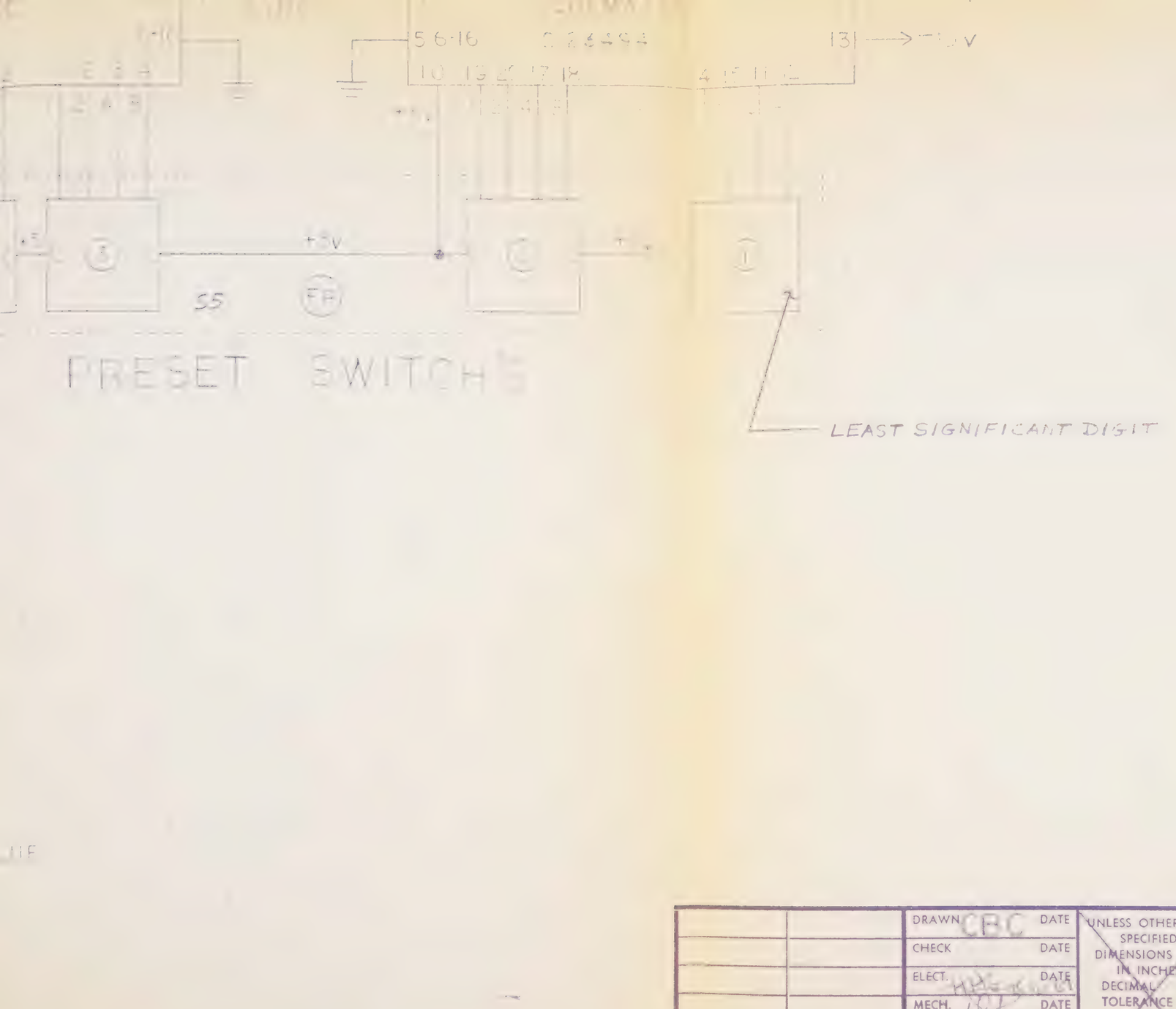
REF ASSEMBLY NO. 17512 SCHEMATIC (FP)



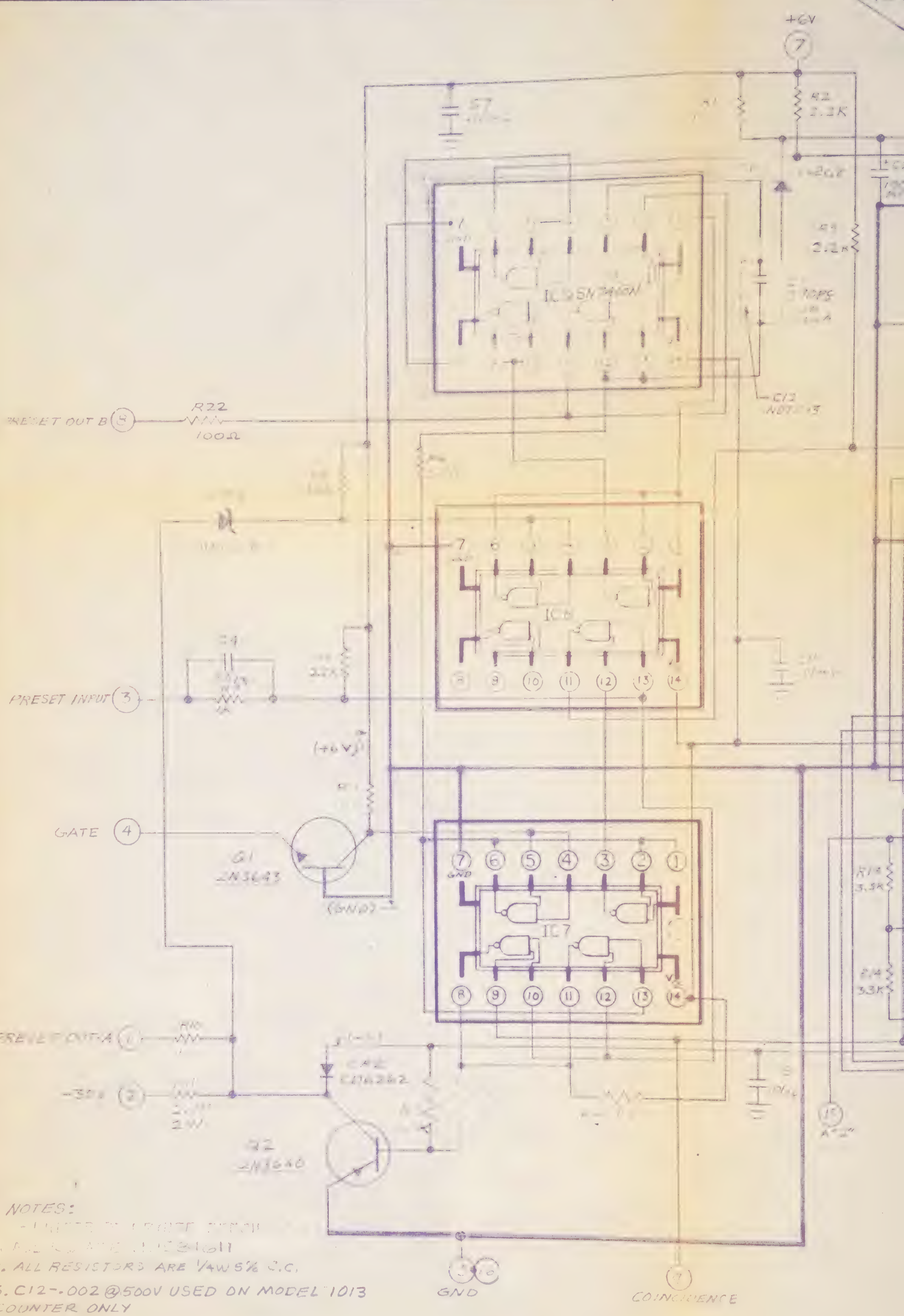
FP

NOTES

1. * NOMINA



		DRAWN CBC DATE	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMAL TOLERANCE .X .XX .XXX ANGLES ±	SYSTRON DONNER CORPORATION CONCORD, CALIFORNIA	BLOCK DIAGRAM 1944-A
		CHECK DATE			
		ELECT. DATE			
		MECH. DATE		MATERIAL	
		PROJECT DATE			
1944-A		APPROVAL DATE			
USED ON	NEXT ASSY	SCALE	DO NOT SCALE DRAWING	DWG SIZE D	DWG NO. S 23572 ISSUE E
APPLICATION				SH OF	

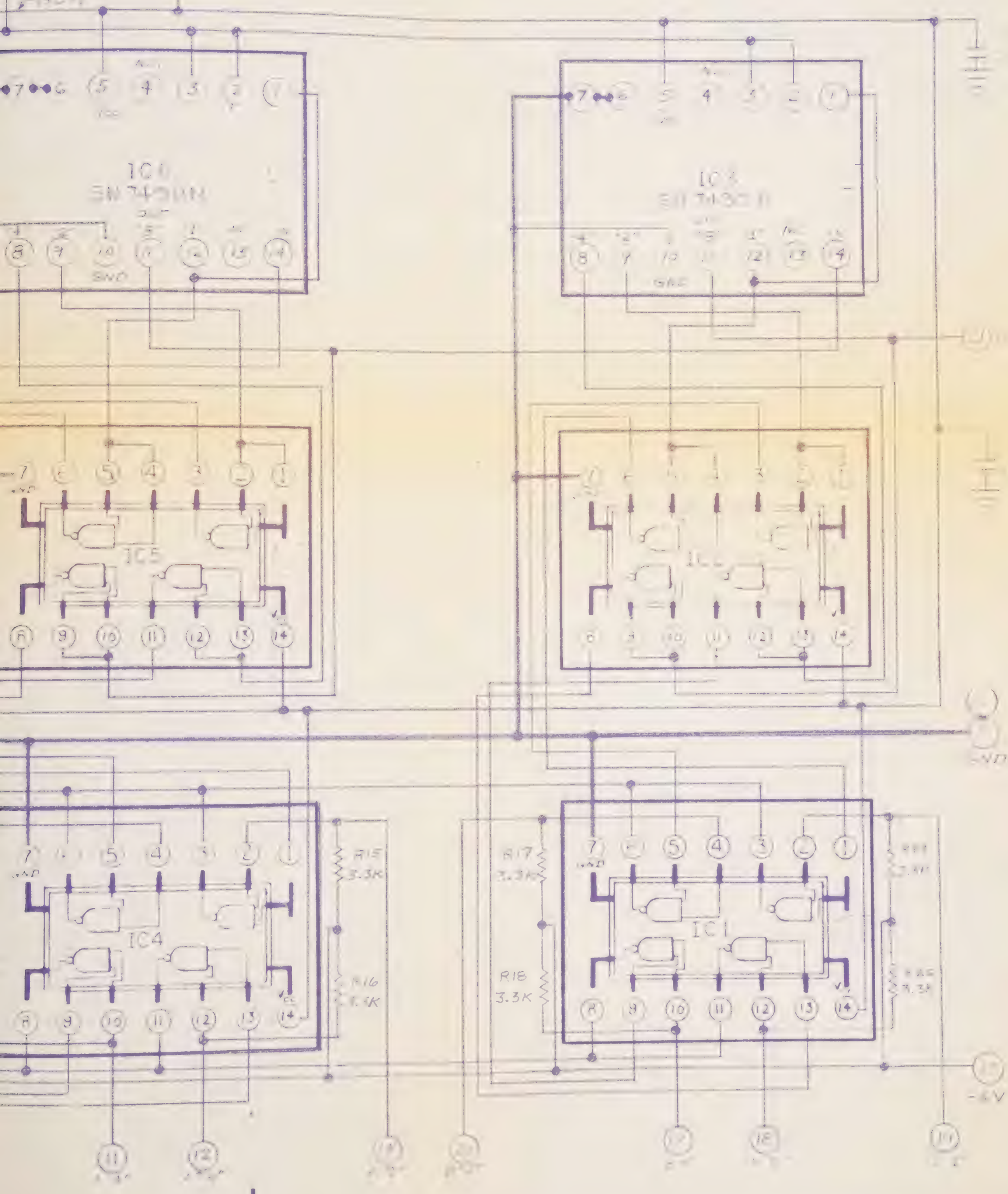


NOTES:

1. [illegible]
2. ALL RESISTORS ARE 1/4W 5% C.C.
3. C12-.002 @500V USED ON MODEL 1013 COUNTER ONLY

22 DECADE ASSY.

REVISIONS					
ISSUE	DESCRIPTION	SER. NO.	ECO NO.	DATE	APP. BY
B	R11 WAS 1K – R12 WAS 1K – CR3 WAS CD6262 – R4 WAS 3.3K IC7 WAS 15846N – R9 WAS 2.2K – ADD: C5, C6, C7, R21	—	AH	9-11-67	
C	R1 WAS 10K – WAS TDN 23 BRD 2 [illegible] SECTION			[illegible]	
D	R12 FROM 2.1K TO 2.0K. ALT FROM 2.1K TO 1K			[illegible]	



ITEM NO	QTY.	PART NUMBER	DESCRIPTION	SCHEMATIC REF. NO.

LIST OF MATERIALS

XXIA	523485
USED ON	NEXT ASSY
APPLICATION	

DRAWN AH 4-5-67 DATE
CHECK DATE
ELEC DATE
MECH DATE
PROJECT DATE
APPROVAL DATE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE
.X
.XX
.XXX
ANGLES

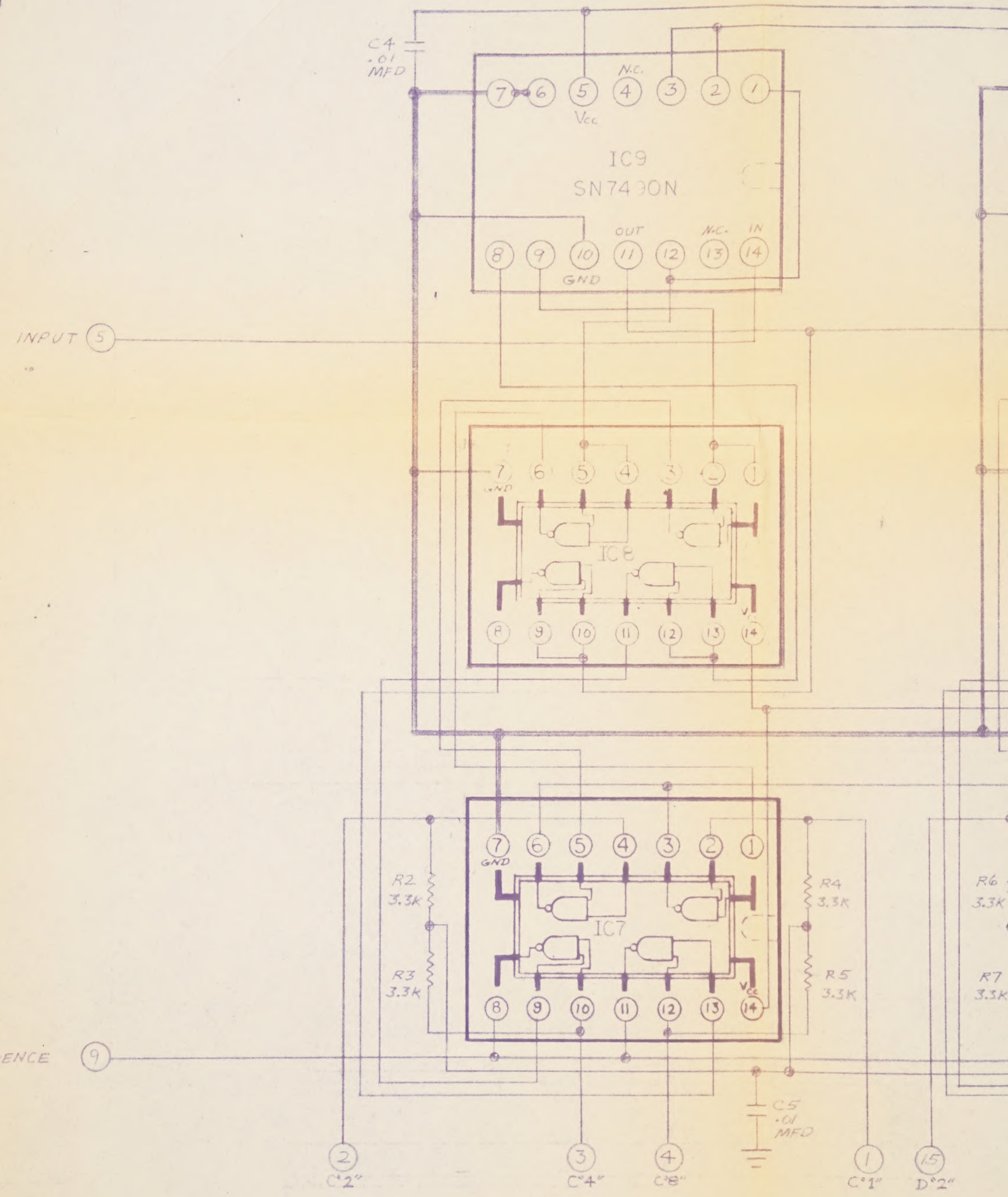
SCALE
DO NOT SCALE DRAWING
DWG SIZE C
SH 1 OF 1

SYSTRON DONNER
CORPORATION
CONCORD, CALIFORNIA

MATERIAL

LOGIC & DECADE P.C.B. SCHEM.

DWG NO. 523484
ISSUE 3 E



NOTES:

1- IC 1, 2, 4, 5, 7 & 8 ARE: SN1584 OR

2- RESISTORS ARE 1/4 W 5% CARBON COMP

REVISIONS					
ISSUE	DESCRIPTION	SER. NO.	ECO NO.	DATE	APP. BY
E	R1 WAS 8.2Ω CHG TO 10Ω			10/3/67	

RESET

+5

(+5V)

C3 .01 MFD

IC6 SN7490N

IC3 SN7490N

IC5

IC2

IC4

IC1

R8 3.3K

R9 3.3K

R10 3.3K

R11 3.3K

R12 3.3K

R13 3.3K

R1 10Ω

C2 .01 MFD

C1 100 MFD

C6 .01 MFD

-6V

GND

OUT

D "4"

D "8"

+6

D "1"

E "2"

E "4"

E "8"

E "1"

LIST OF MATERIALS

1944 A	S-23509	DRAWN AH 5-17-67	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMAL TOLERANCE .X .XX .XXX ANGLES ±	SYSTRON DONNER CORPORATION CONCORD, CALIFORNIA	DECADE BOARD SCHEM. (4)
USED ON	NEXT ASSY	CHECK		MATERIAL —	DWG NO. S23508 ISSUE F
APPLICATION		ELECT. HHG 24 Oct 67			
		MECH.			
		PROJECT			
		APPROVAL			
		SCALE —	DO NOT SCALE DRAWING	DWG SIZE C SH 1 OF 1	

WARRANTY

Systron-Donner instruments are warranted during a period of one year from date of shipment to original purchaser to be free from defects in material and workmanship. This warranty does not apply to vacuum tubes, except as they are warranted by tube manufacturers. The liability of Seller under this warranty is limited to replacing or repairing any instrument or component thereof which is returned by Buyer at his expense during such period and which has not been subjected to misuse, neglect, improper installations, repair, alteration, or accident. Seller shall have the right of final determination as to the existence and cause of a defect. In no event shall Seller be liable for collateral or consequential damages. This warranty is in lieu of any other warranty, express, implied or statutory, and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

RECEIVING INSPECTION

Every Systron Donner instrument is carefully inspected and is in perfect working order at the time of shipment. Each instrument should be checked as soon as received. If the unit is damaged in any way or fails to operate, a claim should immediately be filed with the transportation company.

REPAIRS

Whenever a Systron-Donner instrument requires service, the nearest Systron-Donner representative should be contacted; all representatives will provide immediate service or arrange factory returns when necessary.

Please specify both model and serial number in all correspondence concerning Systron-Donner instruments. Address all inquiries on operation or applications to your nearest sales representative or Sales Manager, Instruments, Systron-Donner Corporation, 888 Galindo Street, Concord, California.

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